USING OPERATIONAL ARCHITECTURE DESIGN TOOLS FOR LIFE-CYCLE SUSTAINMENT PLANNING

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Introduction

Imagine making all the right choices in your next major endeavor. What it would take to make that happen is the ability to look at alternative courses of action, gain insight into their relative merit in given conditions, assess the trade-offs against other alternatives, and predict the future. Except for the last item, the Army might just have such a capability to help in the development of future weapon systems.

With that in mind, the U.S. Army Logistics Integration Agency (USALIA) has the capability to bring process-oriented logisticians together with materiel- and systems-oriented acquisition personnel and operational architecture design tools to analyze sustainment options as they are considered during the life-cycle process. Given today's austere funding environment and the number of years we historically retain our weapon platforms, it is clear we must ensure that we are acquiring new capabilities that can be economically sustained for many years to come. If we look at the ratio of acquisition cost to life-cycle cost for most of the major weapon systems in our current inventory, we can clearly see that sustainment costs typically exceed initial procurement costs by substantial amounts.

DOD Document Changes

Recent changes to the DOD-5000 series of documents have put new emphasis on managing the total life cycle of new weapon systems through the integration of acquisition and logistics processes. DoD Instruction (DoDI) 5000.2, *Operation of the Defense Acquisition System*, states "The outcome of systems acquisition is a system that represents a judicious balance of cost, schedule, and performance in response to the user's expressed need; that is interoperable with other systems…; that uses proven technology, open systems design, available manufacturing capabilities or services, and smart competition; that is affordable; and that is supportable. Once deployed, the system is supported throughout its operational life and eventual disposal in post-systems acquisition using prudent combinations of organic and contractor service provided in accordance with statues."

Further, DoDI 5000.2 tells us that sustainment strategies must evolve and be refined throughout the life cycle. It charges the program, project, or product manager (PM) with the responsibility to ensure that a flexible, performance-oriented strategy to sustain systems is developed and executed. It further elaborates that this strategy will include consideration of the full scope of operational support, such as maintenance, supply, transportation, data management, manpower, and training. This document also advocates the extensive use of modeling, simulation, and analysis throughout the acquisition process to integrate the activities of the principal decision support systems by creating information for decisionmakers.

The Army has implemented its Performance Based Logistics Program in response to this requirement. It is a product support strategy in which the requirements for providing logistical functions are specified in high-level, outcome-oriented performance statements leading to increased availability and readiness of weapon systems and their components. These performance requirements, such as operational availability, mission-capable rate, customer wait time, and life-cycle cost, are usually stated without specifying the processes and procedures to obtain that result. This is where the operational architecture design tool would be applied.

Design Tool

If operational architecture design tools, such as Gensym's G2 Rethink, were used to assess the effect of proposed support strategies on the end-to-end logistics system, the Army might be able to evaluate suggested concepts for support. When applied, such a tool could enable the explicit description and documentation of the desired relationships among the various elements of weapons system sustainment. Alternative logistics concepts could be evaluated to determine the best solution for the specific weapons system being acquired and/or for the unit set of equipment. The goals of this effort would be to contribute to improved readiness and reduce total weapons system life-cycle ownership cost. Direct benefits of using this type of approach include: influence of product design for supportability, support strategy development, and identification of sustainment policy issues requiring resolution.

The Business Process Redesign Laboratory at USALIA has already used G2 Rethink to support the PM Single Stock Fund in examining the requisition and materiel return processes for the entire supply chain. For this project, the tool was instrumented to capture the cost and performance metrics defined by the Single Stock Fund Office.

An ongoing project in the laboratory involves assessing the impact of future embedded diagnostics and prognostics equipment in combat and support systems. Within this concept, data are transferred from the platform to the appropriate decision-making level to expedite repair or replacement actions. This project will enable decisionmakers to see the overall effect on the maintenance process as well as measure resulting changes in operational availability and logistics footprint. Having worked both of these projects, the laboratory is well positioned to apply this experience to life-cycle logistics support planning.

Weapon Systems Sustainment

Here's how it might work for weapon systems sustainment. A "base case" sustainment process would be developed using Army concepts and doctrine as the foundation. As various

sustainment alternatives such as Contractor Logistics Support (CLS) are considered or proposed, they would be quantitatively compared to the base case. Imagine the potential this kind of analysis provides. The Army will have the opportunity to measure the specific impact of certain enablers such as prognostics, diagnostics, modular design of components, multipurpose parts and components, and increased system reliability. It is envisioned that potential "stakeholders" would use the results of this analysis during the Army Systems Acquisition Review Council (ASARC) review process.

The architecture would be developed in an iterative fashion, adding more detail and quantitative capability as needed to support the decision requirements over the acquisition life cycle. Examination of the readiness and supportability characteristics early in the design process will offer the largest range of choices and trade-offs. Specifically, the model could evaluate logistics support alternatives such as CLS supply, CLS maintenance, recapitalization, and prime vendor support to determine the best sustainment strategy over time. In addition, G2 Rethink could measure the effect of these alternatives on areas such as fleet readiness, depot workload, and cost. Adjustments to variables during repeated runs of the model would provide sufficient information on which to base recommended sustainment strategy.

It is understood that core metrics may vary by individual weapons system depending on the operational aspects of the system that the model is examining. The identification of these sustainability variables will be determined in conjunction with PBL parameters. As a minimum, the initial metric's focus will be on both acquisition cost and life-cycle cost.

Life-Cycle Model

Here's how the employment of this operational architecture tool, G2 Rethink, will fit into the Army's life-cycle model. As you know, the ASARC provides senior acquisition managers and functional principals the opportunity to review designated programs. This is done at formal milestones to determine a program or system's readiness to enter the next acquisition phase. They are supported in the decisionmaking process by integrated product teams comprised of representatives of each of the Army staff elements, acquisition support activities such as the Army Materiel Systems Analysis Activity and Cost and Economic Analysis Center, and the appropriate program executive officer and PM offices. The ASARC is co-chaired by the Army Acquisition Executive and the Army Vice Chief of Staff.

The life cycle of an Army weapons system begins at Milestone A when the Milestone Decision Authority (MDA) approves entry into the Concept and Technology Development phase. This phase is characterized by efforts pointed toward a specific military need and the development and evaluation of the feasibility and practicability of proposed solutions. Initial operational support and infrastructure requirements within a family of systems are defined for the most promising concepts during this phase. Life-cycle cost estimates are prepared and logistics planning is initiated. During this phase, the operational architecture design tool would be applied to evaluating the impact of various system design initiatives that directly affect sustainment; e.g., modular design of components and subsystems, redundant system capability, and multipurpose parts or components.

Milestone B

Milestone B typically marks the beginning of an acquisition program and authorizes entry into the System Development and Demonstration Phase of the life cycle. The full funding of the program is also required at Milestone B. This phase has six purposes as follows: development of a system; reduction of program risk; designing for producibility; assuring affordability; ensuring operational supportability; and demonstration of system integration, interoperability, and utility. The Materiel Fielding Plan is drafted and initial provisioning calculations are made during the System Development and Demonstration Phase. The materiel developer also finalizes the documents that describe the number of end items per unit and the number and skill levels of the personnel required to operate and maintain the new weapons system. These documents are used by the combat developer to prepare the final Basis of Issue Plan. In support of this phase, the operational architecture tool could quantify the impact of features such as unambiguous embedded diagnostics and prognostics on system operational availability and force structure requirements.

Milestone C

The Milestone C decision authorizes entry into the Production and Deployment Phase of the life-cycle model. The purpose of this phase is to achieve an operational capability that satisfies mission needs. Low rate initial production gives us a limited quantity necessary for operational testing and ensures manufacturing operations are adequately moving toward full-rate production. Midway through this phase, the MDA makes the full-rate production and deployment decision.

The Operations and Support Phase follows full-rate production and deployment. The sustainment program's objectives are to execute a support program that meets operational support performance requirements and to do so in the most cost-effective way for the life of the weapons system. The PM's sustainment strategy includes consideration of the full scope of operational support, such as maintenance, supply, transportation, sustaining engineering, and spectrum supportability. The operational architecture tool will also provide for periodic reassessments as changes in logistics strategies are considered.

The Army's Future Combat Systems (FCS) is scheduled for an ASARC Milestone B Decision Review on April 15, 2003. Based on past history, we can anticipate that the Army will be fighting with and sustaining this weapons system for many years. This new acquisition program presents an opportunity to apply a business process analysis and specifically the G2 Rethink operational architecture design tool to make the most informed life-cycle sustainment decisions for the FCS.

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